



# CASE REPORTS

## Rupture of Abdominal Aortic Aneurysms Complicated by Acute Renal Failure And Aspergillosis

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THE RECENT OCCURRENCE of two cases of rupture of an abdominal aortic aneurysm, successfully resected, followed by acute renal failure with survival prompted a review of this combination. The occurrence of aspergillosis causing anuria by ureteral obstruction in one of the cases is documented.

Cottage Hospital is a general hospital with 237 beds. In the five-year period from 1957 through 1961, there were 44,748 admissions which included nine cases of ruptured abdominal aortic aneurysm. The average age of the patients with this lesion was 66 years. All were males and the symptoms of the rupture had been present for an average of 22 hours. In those who died without operation, death occurred within 16 hours of admission. Four of the nine patients were operated upon and two survived.

Following are reports of the cases of the two who lived.

CASE 1. A 79-year-old white man was admitted to the Cottage Hospital emergency room April 5, 1961, with chief complaint of cramping in the left lower quadrant of the abdomen for one week. On examination blood pressure was 200/112 mm. of mercury and the pulse rate was 80. There was a grade 2 murmur of aortic stenosis. A rounded mass about three inches in diameter, with a "transmitted pulsation," was palpated in the left lower quadrant of the abdomen. Ninety minutes after admission the patient suddenly developed profound shock while in the x-ray department. In a kidney-ureter-bladder film a large aneurysm with calcification in the wall was visualized. At operation a large retroperitoneal hematoma was noted, with rupture of the abdominal aneurysm, which extended from the level of the renal veins superiorly to the inguinal ligament inferiorly. A Teflon® Y tube was used to replace the diseased segment of aorta, the aorta having been clamped below the renal arteries for a period of 3 hours and 15 minutes while the

procedure was carried out. During the surgical procedure the patient received 15 units of whole blood.

The patient was oliguric from the time of arrival in the intensive care unit. The urine had a specific gravity of 1.005 and showed 1 plus albumin and numerous granular casts. Oliguria continued (50-60 cc. of urine daily) for a total of six days. During that time appropriate intravenous therapy, rigid fluid restriction, general supportive measures and administration of potassium ion exchange resins were carried out. Although the nonprotein nitrogen rose to 132 mg. per 100 cc. and mild metabolic acidosis developed, the patient's general condition did not deteriorate to the point of requiring extracorporeal hemodialysis.

On the sixth postoperative day urine volume began to increase (350 cc. in 24 hours) and by the tenth postoperative day the patient was well into the diuretic phase of acute tubular necrosis. Twenty-five days later the non-protein nitrogen was 46 mg. per 100 cc. and other chemical components of the blood were within normal limits. A moderately heavy growth of *E. coli* developed on a culture of the urine, but after therapy with AzoGantrisin®\* and Mandelamine (methanamine mandelate) the urine culture was sterile.

CASE 2. The patient, a 65-year-old white man, was admitted to the Santa Barbara Cottage Hospital at 6 a.m. September 17, 1961. He was known to have had essential hypertension since 1954. Recent treatment had included Rauwiloid® (alseroxylin), 2 mg. twice a day; Inversine® (mecamylamine), 2.5 mg. each evening; and Diuril® (chlorothiazide), 500 mg. each morning. The morning of admission the patient had pain of sudden onset in the left upper quadrant of the abdomen with radiation to the flank area, the left lower quadrant and the left groin, accompanied by nausea without vomiting.

The patient was pale and perspiring. The blood pressure was 180/110 mm. of mercury and pulse rate 80. A firm mass with transmitted pulsation was palpable in the left lower quadrant of the abdomen. Pulsations were present in the lower extremities at this time.

At operation, done under hypothermia at 31° C., an aneurysm of the aorta, 15 cm. x 10 cm., was found to be ruptured. The aneurysm extended to

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\*Sulfasoxazole with phenylazo-diamino-pyridine hydrochloride.

within 0.5 cm. of the renal arteries, necessitating clamping of the aorta above the origin of the renal arteries. During the procedure, which took seven and a half hours, the aorta was clamped for two hours and thirteen minutes, and the patient received 13 units of whole blood. Because of the involvement of the left renal artery and vein, it was necessary to remove the left kidney (the pathologist reported it arteriosclerotic).

The patient was oliguric on his return to the intensive care unit. A "radioactive renogram" was done on the right side to ascertain whether the oliguria was due to right renal artery occlusion with infarction of the kidney, or due to tubular necrosis. A normal "vascular spike" was obtained, confirming the diagnosis of tubular necrosis.

Azotemia and hyperpotassemia progressed rapidly during the early phase of oliguria, and the patient's general clinical status deteriorated. On the fourth day extracorporeal hemodialysis was carried out with a Travenol® twin coil kidney for a period of six hours, and his clinical condition then greatly improved. In spite of conservative medical management with appropriate fluid restriction and ion exchange resins for control of serum potassium levels, acidosis, azotemia, and hyperpotassemia increased and, on the tenth day of renal shut-down, extracorporeal hemodialysis again was carried out for six hours. Appropriate medical management was continued, and by the sixteenth postoperative day urine output had increased to 620 cc. in 24 hours.

From the seventeenth postoperative day the patient entered the diuretic phase. Adequate fluid and electrolyte replacement was maintained and the clinical condition of the patient improved as azotemia diminished. Because of complicating tracheobronchial and lower urinary tract infections occurring within three weeks of operation, the patient received chloramphenicol for five days, terramycin for five days, and streptomycin every other day for five injections.

Approximately a month after the second dialysis the patient suddenly became anuric. Urological consultation was obtained, and at cystoscopic examination a large 0.75 cm. x 0.5 cm. plug of "whitish tissue" was noted to be occluding the lower right ureter. It was removed and a retrograde pyelogram then revealed no evidence of abnormality. Urine volume immediately increased, and the patient's general clinical condition progressed satisfactorily. By microscopic analysis and bacteriologic study the plug of material removed at cystoscopy was found to be *Aspergillus fumigatus*.

#### DISCUSSION

Rupture of the lesion is one of the more frequent causes of death in patients with arteriosclerotic abdominal aneurysm.<sup>20,30</sup> It has been calculated that 2,450 people die of it each year in the United States.<sup>5</sup>

There is usually a period of hours to days between rupture and death. Owing to the retroperi-

toneal position of the aorta, the initial blood loss from the vessel is usually confined by the peritoneal surface, and it is not until the peritoneum ruptures that death occurs.<sup>8</sup> Before aortic resection and graft replacement was surgically feasible, rupture of the aneurysm was fatal. Now, with operation, 50 to 60 per cent of patients survive.<sup>13,15</sup>

Acute renal failure is a frequent and often fatal complication of operation on the aorta, causing death in 10 to 60 per cent of reported series. The exact pathogenesis of renal failure is not known, but some of the factors are atherosclerosis, shock, transfusions, hydration of patients, reflex renal vasospasm, and the location and duration of aortic cross-clamping.\* It is becoming apparent that the more important features are reflex renal vasospasm and renal ischemia from cross-clamping.

How long the flow of blood to the kidneys can be occluded without producing irreversible ischemic changes in them is not known. It was shown in animals that when both the suprarenal aorta and renal arteries were clamped for from two to three hours, severe renal damage resulted. When only the suprarenal aorta was occluded for the same period of time much less damage occurred, suggesting a collateral flow through the renal capsule.<sup>23,24</sup> It has been found in patients with normal kidneys that occlusion of the suprarenal aorta for periods greater than 30 to 40 minutes may result in renal failure, whereas infrarenal aortic occlusion of 1 to 2 hours may be tolerated safely. Hypothermia does not per se produce any residual damage to the kidneys; it lowers tissue metabolism to a point at which renal ischemia for a prolonged period may not result in irreversible renal damage. Hypothermia to 27° C. doubled the period for which arterial occlusion could be maintained without severe renal damage. It results in decrease of blood pressure with reduced glomerular filtration fraction, but without the associated decreased urinary volume or significant decrease in sodium excretion that usually occurs in normothermic conditions following any procedure that reduces glomerular filtration rate.<sup>21</sup> As delivery of oxygen depends not only on the flow of blood but also on the state of the vascular bed in the kidneys, the addition of ganglionic blockade by operation or by sympatholytic drugs helps prevent renal vasospasm, increase vascular resistance and reduce the severity of renal damage.<sup>22,24,29,31</sup>

It has been suggested that administration of Mannitol® (a hexahydric alcohol) is a safe effective way of preventing acute functional renal failure.<sup>4</sup> It is a small particle that is slow to equalize with the extravascular compartments after an intravenous infusion. As it is filtered at the renal glomerulus and non-reabsorbable from the tubular lumen, it results in osmotic diuresis. The method used by Barry and coworkers<sup>4</sup> was to infuse it as a 20 per cent solution at a rate of 5.5 cc. per minute during aneurysmectomy until the free flow of blood was reestablished. If, after operation, the urine excretion fell to below 60 cc. per hour

\*References Nos. 2, 10, 12, 14, 16, 18, 22, 27, 31.

for two successive hours, booster doses of 12.5 gm. of Mannitol® were given intravenously over a three-minute period and thereafter the agent was added to each bottle of intravenous fluid as needed to maintain a urinary flow of 60 to 120 cc. per hour.

Severe oliguria is usually preceded by a depression of the renal blood flow and glomerular filtration rate. Clinical studies<sup>3</sup> showed that Mannitol infusions increase the renal blood flow, the glomerular filtration rate and the urinary flow. It was also observed that the rate of urinary flow varies directly with the renal blood flow and the glomerular filtration rate. The plasma expansion resulting from use of Mannitol® is determined by the total quantity of the agent infused, the rate of infusion, and the rate at which it leaves the vascular compartments.<sup>3</sup> In an oliguric patient the recommended test dose of 12.5 gm. of Mannitol® is given in a three-minute interval. If a satisfactory response is obtained, 30 cc. per hour during the ensuing three hours is infused. Thereafter enough Mannitol is used to maintain a urinary flow of 60 to 120 cc. per hour until the danger of renal failure has passed.

The severity of renal failure following aortic operations is variable, as was shown in Cases 1 and 2 reported herein. In Case 2 the renogram permitted differentiation between renal artery occlusion and acute tubular necrosis in the remaining kidney as the cause of the anuria. The renogram showed an adequate initial vascular spike representing renal vascular capacity that would have been absent had the renal artery been occluded.<sup>1,32</sup>

Anuria occurring during the diuretic phase secondary to ureteral blockage by a ball of *Aspergillus fumigatus* has not been described in the literature before. The presence of balls of *Candida albicans* in the bladder has been reported and there is one report of *Candida* blocking a ureter in a case of disseminated fungous disease.<sup>6,11,28</sup> *Aspergillus*, a mold, is a frequent laboratory contaminant and not a common pathogen of man. The manifestations are protean and depend on the organ involved. Lungs, skin, eyes, ears, bronchi, nails, bone and meninges have all been involved.<sup>9,17,19,25,26</sup> *Aspergillo*sis usually occurs in patients who are chronically ill and who have received antibiotics and steroids. These agents alter or suppress the resistance to *Aspergillus fumigatus* and allow it to become clinically important. In Case 2 the patient had received chloramphenicol, terramycin and streptomycin. The finding of this ball of *Aspergillus fumigatus* was the only indication of this condition present in this patient, and whether or not parenchymal damage secondary to this fungus may appear in the future is not clear at this time. At present there is no indication of clinically significant *aspergillo*sis.

#### SUMMARY

Two patients who had rupture of an abdominal aortic aneurysm and then acute renal failure following aortic resection have been reported. One

patient, after having the infrarenal aorta clamped for 3 hours and 15 minutes, had clinical uremia which responded to conservative management. In the other patient the operation was performed under hypothermia of 31° C. and the suprarenal aorta was clamped for 2 hours and 13 minutes. One kidney was removed and tubular necrosis developed in the other. In the diuretic phase the patient had ureteral obstruction caused by a ball of *Aspergillus fumigatus*. The decision to treat this patient as having acute tubular necrosis rather than renal artery occlusion following the aortic operation was based on information supplied by a renogram with radioactive material.

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